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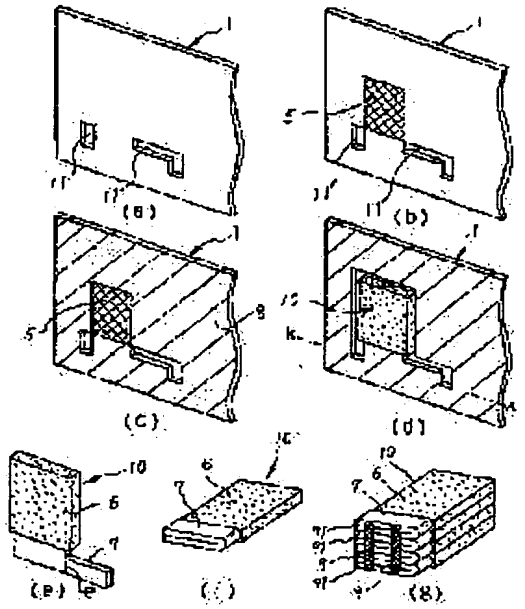
(54) LAYERED SOLID CAPACITOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a layered solid capacitor in which distortion caused by a difference in thickness of an anode electrode part and a cathode electrode part is removed, and joining of a laminate of anode electrode parts on which a dielectric oxide films are formed can easily be performed, thereby the lamination thereof is easily carried out.

SOLUTION: Four flat plate solid capacitor elements 10 are provided, in which a dielectric oxide coating film, a conductive functional high polymer film and a conductive layer are laminated on a specified part of the surface of a metal plate 1 to form a cathode electrode part 6, and the part where the conductive layer, etc., is not provided is made an anode electrode part 7. By bending the anode electrode parts 7 of each flat plate solid capacitor elements 10 double, the thickness thereof is made equal to that of the cathode electrode part 6, and these flat plate solid capacitor elements 10 are stacked to join the cathode electrode parts 6 and the anode electrode parts 7, respectively. The anode electrode parts 7 are joined to one another by providing a cut surface 91, where an inner metal is exposed, at a specified part of the outer periphery of the anode electrode part 7, to weld each adjoining cut surfaces 91 to each other.



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CLAIMS

[Claim(s)]
[Claim 1] While making a conductor layer into the cathode polar zone by forming a dielectric oxide film in the predetermined part of the front face of a metal plate, forming a conductive functional poly membrane in this dielectric oxide film front face, and preparing a conductor layer in the front face of this conductive functional poly membrane Two or more monotonous mold solid-state capacitor elements which become considering the part of the metal plate which has not prepared the conductive functional poly membrane and the conductor layer as anode plate polar zone are provided. In the laminating mold solid-state capacitor which accumulates these two or more monotonous mold solid-state capacitor elements, and comes to join the cathode polar zone and anode plate polar zone, respectively The laminating mold solid-state capacitor characterized by making said anode plate polar zone into the thickness of the cathode polar zone, and the thickness of an abbreviation EQC by bending to a duplex at least.
[Claim 2] At the edge which does not form in a front face the conductive functional poly membrane and conductor layer of a metal plate which come to carry out the laminating of a dielectric oxide film, a conductive functional poly membrane, and the conductor layer While making a conductor layer into the cathode polar zone by joining the auxiliary terminal for anode plates made from a metal plate which comes to form a dielectric oxide film in a front face Two or more monotonous mold solid-state capacitor elements which become considering the auxiliary terminal for anode plates as anode plate polar zone are provided. The auxiliary terminal for anode plates used as the anode plate polar zone of each monotonous mold solid-state capacitor element is made into the thickness of the cathode polar zone, and the thickness of an abbreviation EQC by bending to a duplex at least. And the laminating mold solid-state capacitor characterized by accumulating said two or more monotonous mold solid-state capacitor elements, and coming to join the cathode polar zone and anode plate polar zone, respectively.
[Claim 3] It is the laminating mold solid-state capacitor according to claim 1 or 2 which prepares the cutting plane which exposes an internal metal to the predetermined part of the periphery side of said anode plate polar zone, and is characterized by forming junction of anode plate polar zone of welding between these cutting planes.
[Claim 4] The laminating mold solid-state capacitor according to claim 2 characterized by forming thickly the thickness of the dielectric oxide film on said auxiliary terminal for anode plates to extent by which this conductive functional poly membrane is not formed in the dielectric oxide film front face on said auxiliary terminal for anode plates in case a conductive functional poly membrane is formed in the front face of the dielectric oxide film on said metal monotonous by the electrolytic oxidation polymerization.
[Claim 5] Junction on said auxiliary terminal for anode plates and metal plate is a laminating mold solid-state capacitor according to claim 2 characterized by being ultrasonic welding junction, electric spot welding junction, or mechanical sticking-by-pressure junction.
[Claim 6] The laminating mold solid-state capacitor according to claim 2 characterized by forming the insulating band which becomes the part which joined said auxiliary terminal for anode plates and metal plate from insulating resin.
[Claim 7] The laminating mold solid-state capacitor according to claim 2 characterized by having joined said anode plate polar zone to another lead terminal of a leadframe by laser welding, and carrying out mold shaping of the perimeter by insulating resin while joining said cathode polar zone to the lead terminal of a leadframe with a silver paste.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the laminating mold solid-state capacitor which comes to carry out the laminating of two or more monotonous mold solid-state capacitor elements which use as a solid electrolyte the conductive functional poly membrane formed on the dielectric oxide film.
[0002]
[Description of the Prior Art] Although the capacitor with the sufficient property of operating in a high frequency field with carrying[a miniaturization /]-izing of electronic equipment was required, since the electrolytic property was bad, a conventional aluminium electrolytic capacitor or a conventional solid-state tantalum electrolytic capacitor were not able to meet the demand enough in the high frequency field.
[0003] On the other hand, as compared with the liquid electrolyte and manganese dioxide of the former [resistivity / of a conductive functional poly membrane], for this reason, the solid-state capacitor which uses a conductive functional poly membrane as a solid electrolyte can have small equivalent-series-resistance (ESR) value and in PITANSU value of a capacitor in a RF field, and can meet said demand now very small (1/100 or less).
[0004] This kind of solid-state capacitor element 80 forms the aluminum anodic oxide film (dielectric oxide film) 103 in the front face of the metal plate 101 which consists of aluminum foil (or aluminum plate) which carried out surface roughening of the front face, as shown in drawing 7 . Print the insulating band 102 around the predetermined location of the aluminum anodic oxide film 103, and it classifies into the anode plate polar zone 81 and the cathode polar zone 83. The conductive functional poly membrane 104 is formed in the front face of the aluminum anodic oxide film 103 of the cathode polar zone 83, and the conductor layer 105 which consists of a graphite layer 151 and a silver paste layer 153 is further formed on it, and it is constituted.
[0005]
[Problem(s) to be Solved by the Invention] However, when the laminating of two or more solid-state capacitor elements 80 which use the above-mentioned conventional conductive functional poly membrane as a solid electrolyte was carried out, there were the following troubles.
[0006] Namely, although the solid-state capacitor element 80 of two or more monotonous molds is accumulated for laminating this solid-state capacitor element 80 as shown in drawing 8 , and those cathode polar-zone 83 comrades and anode plate polar-zone 81 comrades are performed by joining, respectively When there is a difference of thickness in the anode plate polar zone 81 and the cathode polar zone 83 of this solid-state capacitor element 80, therefore these [two or more] are joined, as shown in drawing 8 , it will have to curve and distortion will produce the thin anode plate polar zone 81.
[0007] And since there is a possibility of generating short-circuit etc. when the distortion is added in the cathode polar zone 83, it is necessary to ease the distortion. Then, the long die length of the anode plate polar zone 81 was taken, clearance of the joint of anode plate polar-zone 81 comrades and the joint of cathode polar-zone 83 comrades was lengthened, and distortion was made to absorb in the part. However, if the long die length of the anode plate polar zone 81 is taken, the problem that the miniaturization of a capacitor cannot be attained will arise.
[0008] When the aluminum anodic oxide film 103 (refer to drawing 7) which consists of an insulating material on the aluminum foil which, on the other hand, serves as the anode plate polar zone 81 was covered, there was also a problem that junction of anode plate polar-zone 81 comrades will become difficult.

[0009] Junction of the anode plate polar zone in which the purpose removed distortion generated from the

difference of the thickness of the anode plate polar zone and the cathode polar zone by making this invention in view of an above-mentioned point, and the dielectric oxide film was formed is made easy, and it is in offering the laminating mold solid-state capacitor which can perform the lamination easily from these things.

[0010]

[Means for Solving the Problem] In order to solve the above-mentioned trouble invention of a publication to this application claim 1 While making a conductor layer into the cathode polar zone by forming a dielectric oxide film in the predetermined part of the front face of a metal plate, forming a conductive functional poly membrane in this dielectric oxide film front face, and preparing a conductor layer in the front face of this conductive functional poly membrane Two or more monotonous mold solid-state capacitor elements which become considering the part of the metal plate which has not prepared the conductive functional poly membrane and the conductor layer as anode plate polar zone are provided. These two or more monotonous mold solid-state capacitor elements were accumulated, and in the laminating mold solid-state capacitor which comes to join the cathode polar zone and anode plate polar zone, respectively, it was made the thickness of the cathode polar zone, and the thickness of an abbreviation EQC, and constituted from bending said anode plate polar zone to a duplex at least. Invention according to claim 2 at moreover, the edge which does not form in a front face the conductive functional poly membrane and conductor layer of a metal plate which come to carry out the laminating of a dielectric oxide film, a conductive functional poly membrane, and the conductor layer While making a conductor layer into the cathode polar zone by joining the auxiliary terminal for anode plates made from a metal plate which comes to form a dielectric oxide film in a front face Two or more monotonous mold solid-state capacitor elements which become considering the auxiliary terminal for anode plates as anode plate polar zone are provided. The auxiliary terminal for anode plates used as the anode plate polar zone of each monotonous mold solid-state capacitor element is made into the thickness of the cathode polar zone, and the thickness of an abbreviation EQC by bending to a duplex at least. And said two or more monotonous mold solid-state capacitor elements were accumulated, it joined, respectively and the cathode polar zone and anode plate polar zone were constituted.

[0011]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained to a detail based on a drawing.

The [first operation gestalt] Drawing 1 is drawing showing the manufacture approach of the laminating mold solid-state capacitor concerning the first operation gestalt. For manufacturing this laminating mold solid-state capacitor, as shown in this drawing (a), two holes 11 and 11 of a predetermined configuration are first formed in the metal plate 1 made from aluminium foil by cutting etc.

[0012] Next, as shown in this drawing (b), after carrying out printing formation of the photoresist film 5 at the front rear face of the part of the upper part between two holes 11 and 11, as shown in this drawing (c), thick-film chemical conversion generates the aluminum anodic oxide film (dielectric oxide film) 8 for the metal plate 1 whole into parts other than photoresist film 5.

[0013] Next, cut the perimeter of a part in which the photoresist film 5 was formed as the photoresist film 5 was shown in this drawing (d) after exfoliating, and etching processing is performed. Surface roughening of the part which exfoliated the photoresist film 5, and the surrounding cutting side face is carried out. It forms by-izing processing. then, this side top by which surface roughening was carried out -- an aluminum anodic oxide film (dielectric oxide film) -- formation -- The conductive functional poly membrane used as a solid electrolyte is formed in the top face by the electrolytic oxidation polymerization, a conductor layer (it consists of a graphite layer and a silver paste layer) is further formed in the top face, and this constitutes the monotonous mold solid-state capacitor element 10.

[0014] In addition, the part of the metal plate 1 which formed said aluminum anodic oxide film into a 0.5wt% pyrrole, the 0.5wt% BOROJI ammonium salicylate, and the acetonitrile solution containing 0.5wt% pure water like the approach indicated by JP,1-58856,B as the concrete formation approach of said conductive functional poly membrane and which carried out surface roughening is immersed, the metal plate 1 is made into an anode plate, a counterelectrode is used as cathode, and the approach of performing an electrolytic oxidation polymerization is used.

[0015] Next, by cutting by cutting-plane-line k-k shown in this drawing (d), the monotonous mold solid-state capacitor element 10 shown in this drawing (e) is started from the metal plate 1. The part in which the part in which said conductor layer of this monotonous mold solid-state capacitor element 10 etc. was formed does not form the cathode polar zone 6, a conductor layer, etc. becomes the anode plate polar zone 7. The anode plate polar zone 7 serves as a configuration which bends in the shape of L character.

[0016] And it considers as the condition which the anode plate polar zone 7 is folded up to a duplex in the part of the bending line e of this drawing (e), and shows in this drawing (f).
[0017] And as shown in this drawing (g), two or more monotonous mold solid-state capacitor elements 10 are accumulated, the cathode polar-zone 6 comrades and anode plate polar-zone 7 comrades are joined, respectively, and a laminating mold solid-state capacitor is constituted.
[0018] Electroconductive glue (silver paste) performs junction of cathode polar-zone 6 comrades, and junction of anode plate polar-zone 7 comrades is performed by carrying out between the cutting planes 91 prepared the periphery side laser-welding 9. Since the field of the anode plate polar zone 7 is covered with the aluminum anodic oxide film 8, between the cutting planes 91 which Uchibe's aluminum foil has exposed by cutting the metal plate 1 by cutting-plane-line k-k of said drawing 1 (d) is welded.
[0019] Since the anode plate polar zone 7 was bent to the duplex as mentioned above, thickness of the anode plate polar zone 7 is made to the thickness and the abbreviation EQC of the cathode polar zone 6, when the laminating of the monotonous mold solid-state capacitor element 10 is carried out by this, distortion by the anode plate polar zone 7 is decreased or lost, compared with the former, the die length of the anode plate polar zone 7 can be shortened, and a miniaturization can be attained.
[0020] The [second operation gestalt] Drawing 2 and drawing 3 are drawings showing the manufacture approach of the laminating mold solid-state capacitor concerning the second operation gestalt.
[0021] As first shown in drawing 2 (a), the auxiliary terminal assembly 21 for anode plates made from aluminium foil and the metal plate 31 made from aluminium foil are prepared.
[0022] The auxiliary terminal assembly 21 for anode plates is an abbreviation rectangle-like, it formed the crevice 23 in this center of the end side while it extended the end crosswise, and it has formed the through tubes 25 and 25 of an ellipse configuration in the both sides of this crevice 23 here. And the aluminum anodic oxide film (dielectric oxide film) 27 is formed in the whole field of this auxiliary terminal assembly 21 for anode plates by chemical conversion.
[0023] There is the following as an approach of forming the aluminum anodic oxide film 27 here.
** How to use an anode plate the auxiliary terminal assembly 21 for anode plates, and form the aluminum anodic oxide film 27 on this auxiliary terminal assembly 21 for anode plates by using a counterelectrode as cathode in this water-soluble electrolytic solution, using the water-soluble electrolytic solutions, such as a boric acid, an adipic acid, a citric acid, a phosphoric acid, or its salt.
[0024] ** How to use an anode plate the auxiliary terminal assembly 21 for anode plates, and form the aluminum anodic oxide film 27 on this auxiliary terminal assembly 21 for anode plates by using a counterelectrode as cathode in this water-soluble electrolytic solution, using the water-soluble electrolytic solutions, such as oxalic acid, a sulfuric acid, or its salt.
[0025] In addition, this aluminum anodic oxide film 27 may be homogeneous as the aluminum anodic oxide film 35 which carries out the following.
[0026] On the other hand, the metal plate 31 is an abbreviation square-like, it projects on both sides of the end side, and pieces 33 and 33 are formed. And surface roughening of the whole front face of this metal plate 31 is carried out by etching.
[0027] Next, as shown in drawing 2 (b), the pieces 33 and 33 of a protrusion of said metal plate 31 are contacted as the crevice 23 is straddled the end side of the auxiliary terminal assembly 21 for anode plates, and it joins by electric spot welding.
[0028] In addition, the ultrasonic welding junction and mechanical sticking-by-pressure junction other than electric spot welding may be used for both junction.
[0029] Next, the aluminum anodic oxide film (dielectric oxide film) 35 is formed in the whole front face of said metal plate 31 by chemical conversion.
[0030] Next, insulating resin is applied to the perimeter of the predetermined part by the side of the metal plate 31 of the part which joined the auxiliary terminal assembly 21 for anode plates, and the metal plate 31 as shown in drawing 2 (c), and the insulating band 37 is formed in it.
[0031] Next, a conductive functional poly membrane is formed in the whole field by the side of the metal plate 31 divided with the insulating band 37 by the electrolytic oxidation polymerization, the conductor layer 45 which consists of a graphite layer and a silver paste layer is further formed in the front face, and it considers as the condition which shows in drawing 2 (d).
[0032] Next, if the A-A line shown in drawing 2 (d) cuts the auxiliary terminal assembly 21 for anode plates, it will be in the condition that two auxiliary terminals 29 and 29 for anode plates were joined to the metal plate 31, as [show / in drawing 3 (a)].
[0033] And if the part of the outside of two auxiliary terminals 29 and 29 for anode plates is turned up to a

rear-face side and laid on top of a duplex as an arrow head shows, the monotonous mold solid-state capacitor element 20 as shown in drawing 3 (b) will be completed. The cathode polar zone 63 and the auxiliary terminals 29 and 29 for anode plates serve as [the conductor layer 45] the anode plate polar zone 61 here.

[0034] Next, these two monotonous mold solid-state capacitor elements 20 are prepared, as shown in drawing 4 , the laminating of the silver paste is applied and carried out to these conductor layer 45 front faces, and between both the conductors layer 45 and 45 is joined by hardening a silver paste.

[0035] At this time, since the auxiliary terminal 29 for anode plates is bent by the duplex, it connects both the anode plate polar zone 61 and 61 only by becoming the thickness of the cathode polar zone 63 and abbreviation identitas to which that thickness carried out the laminating of the conductor layer 45 grade, therefore carrying out the laminating of the monotonous mold solid-state capacitor element 20.

[0036] Next, 2 sets of laminated two-piece solid-state [1 set of monotonous mold] capacitor elements 20 are prepared, and as shown in drawing 5 , the laminating of these is carried out to the top face and inferior surface of tongue of a leadframe 50, respectively.

[0037] A leadframe 50 possesses the lead terminal 51 of every four right and left, joins six of them to the conductor layer 45 of the monotonous mold solid-state capacitor element 20, and is joining two to the auxiliary terminal 29 for anode plates here.

[0038] Junction to the lead terminal 51 of the conductor layer 45 is performed by the silver paste here. Moreover, junction between the auxiliary terminal 29 for anode plates and a lead terminal 51 and junction of auxiliary terminal 29 comrades for anode plates are performed by carrying out the cutting plane 291 and lead terminal 51 which were formed the periphery side of each auxiliary terminal 29 for anode plates laser-welding 293. Since the field of the auxiliary terminal 29 for anode plates is covered with the aluminum anodic oxide film 27 (refer to drawing 2 (a)), between the cutting planes 291 which Uchibe's aluminum foil has exposed by cutting the auxiliary terminal assembly 21 for anode plates by cutting-plane-line A-A shown in drawing 2 (d) is welded.

[0039] Even if it was the auxiliary terminal 29 for anode plates covered with this with the aluminum anodic oxide film 27, it becomes possible to weld this behind a laminating, and it could laminate the monotonous mold solid-state capacitor element 20 easily by this.

[0040] Next, as shown in drawing 6 , after carrying out mold shaping of the perimeter of this laminated monotonous mold solid-state capacitor element 20 by the insulating resin 55 which consists of thermosetting or thermoplastics, each lead terminal 51 is cut from a leadframe 50, and if the lead terminal 51 which projects from insulating resin 55 is bent to the rear-face side of insulating resin 55, the laminating mold solid-state capacitor of a chip mold will be completed.

[0041] By the way, although the insulating band 37 (refer to drawing 2 (c)) was formed in order to classify the anode plate polar zone 61 and the cathode polar zone 63 and not to carry out the laminating of the conductive functional poly membrane etc. to the anode plate polar-zone 61 side in this operation gestalt Rather than the formation voltage V2 at the time of forming the aluminum anodic oxide film 35 in the metal plate 31, if formation voltage V1 at the time of forming the aluminum anodic oxide film 27 in said auxiliary terminal assembly 21 for anode plates is made into high formation voltage more than 10V Namely, if only predetermined thickness thickens thickness of the aluminum anodic oxide film 27 rather than the thickness of the aluminum anodic oxide film 35 It becomes unnecessary to use the insulating band 37 which this conductive functional poly membrane was no longer formed in the part which formed said aluminum anodic oxide film 27 at the time of formation of a conductive functional poly membrane, and was used with this operation gestalt. This point is the same also in the first operation gestalt.

[0042] In addition, as a metal which forms the dielectric oxide film, what is necessary is just metals which can form the dielectric oxide film in a front face, such as titanium, a tantalum, and its sintered compact, also except aluminum.

[0043]

[Effect of the Invention] As explained to the detail above, according to this invention, it has the following outstanding effectiveness.

** since the anode plate polar zone was laminated in the condition of having folded up to the duplex at least -- the thickness of the anode plate polar zone and the cathode polar zone -- abbreviation -- become the same, and it becomes easy to laminate [of a monotonous mold solid-state capacitor element], and distortion stops arising in the anode plate polar zone, and the miniaturization can also be attained.

[0044] ** Since it constituted so that the cutting plane might be welded after laminating the anode plate polar zone covered with the dielectric oxide film, lamination of a monotonous mold solid-state capacitor

element becomes easy.

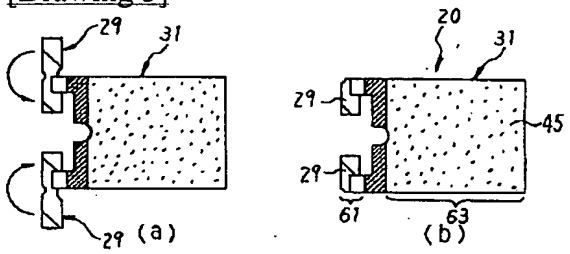
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

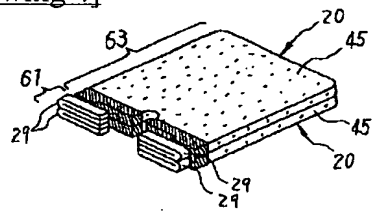
DRAWINGS

[Drawing 3]



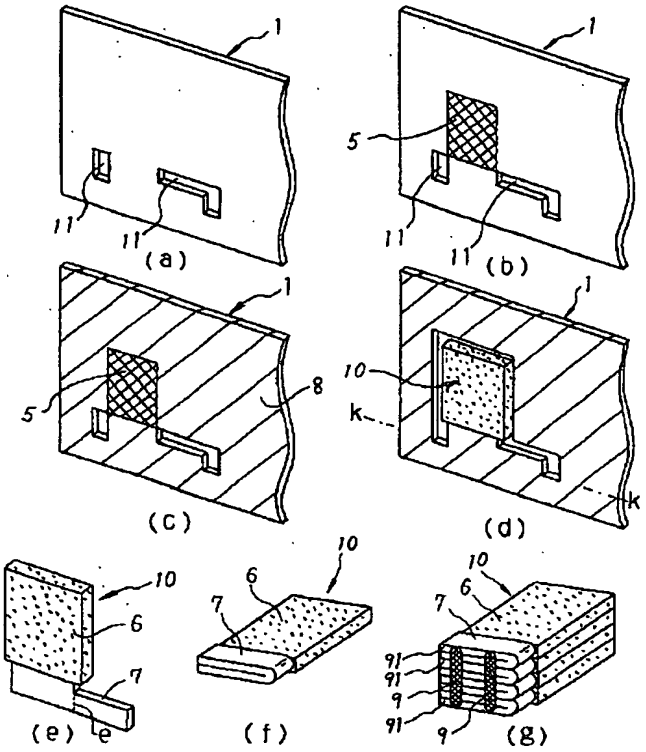
第二実施形態の製造方法を示す図

[Drawing 4]



平板型固体コンデンサ素子２０の積層方法を示す図

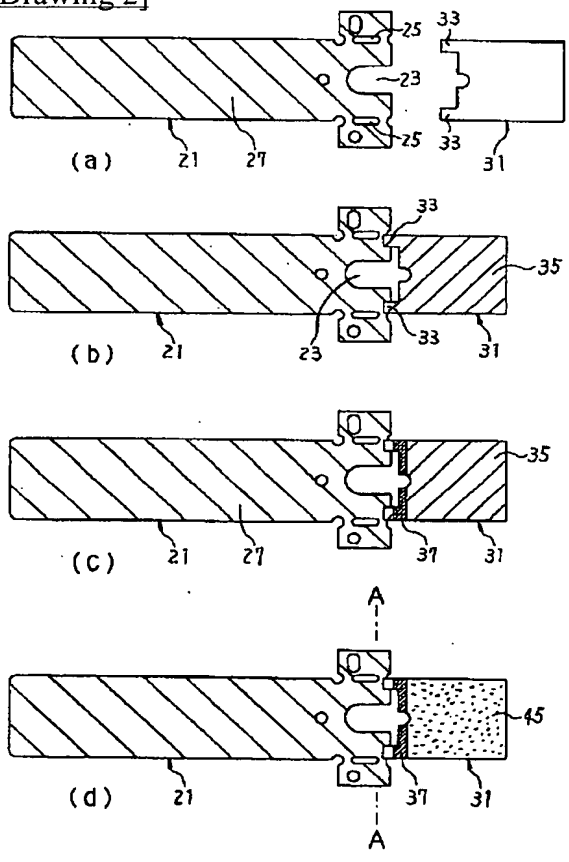
[Drawing 1]



1 金属平板 6 陰極電極部 7 陽極電極部 8 切断面
9 レーザ溶接 10 平板型固体コンデンサ素子

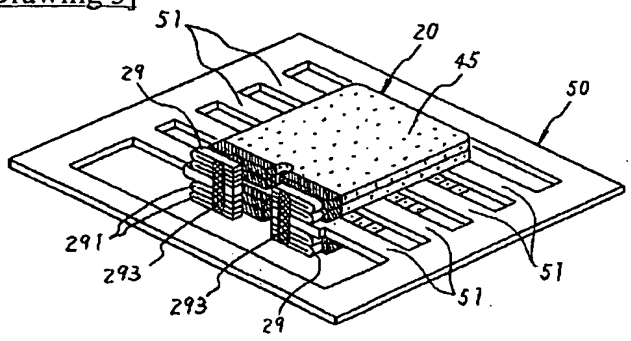
第一実施形態の製造方法を示す図

[Drawing 2]



第二実施形態の製造方法を示す図

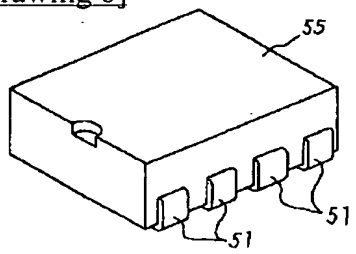
[Drawing 5]



２０ 平板型固体コンデンサ素子　２９ 陽極用補助端子　２９１ 切断面
２９３ レーザ溶接　４５ 導電体層　５０ リードフレーム　５１ リード端子

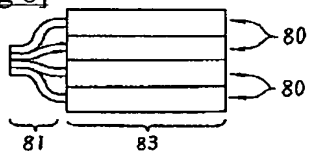
リードフレーム５０への取付方法を示す図

[Drawing 6]



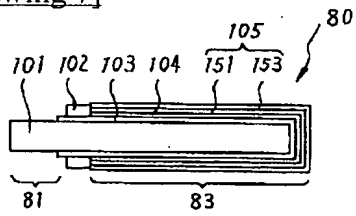
チップ型の積層型固体コンデンサを示す図

[Drawing 8]



平板型固体コンデンサ素子８０の積層方法を示す図

[Drawing 7]



従来の平板型固体コンデンサ素子８０を示す図

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号

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9/048		9/04	328	
9/012		9/05		P

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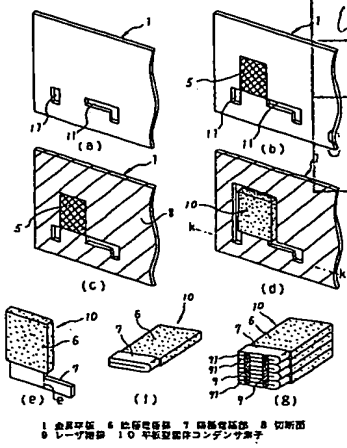
最終頁に続く

(54)【発明の名称】積層型固体コンデンサ

(57)【要約】

【課題】　陽極電極部と陰極電極部の厚みの差から生じる歪を除去し、また誘電体酸化皮膜が形成された陽極電極部を積層したものの接合が容易に行え、これらのことからその積層化が容易に行える積層型固体コンデンサを提供する。

【解決手段】　金属平板１の表面の所定部分に誘電体酸化皮膜と導電性機能高分子膜と導電体層を積層することによって陰極電極部６を形成すると共に、導電体層等を設けていない部分を陽極電極部７としてなる平板型固体コンデンサ素子１０を４個具備する。各平板型固体コンデンサ素子１０の陽極電極部７を２重に折り曲げることで陰極電極部６の厚みと略同等の厚みとし、これら平板型固体コンデンサ素子１０を積み重ねて陰極電極部６同士と陽極電極部７同士とをそれぞれ接合する。陽極電極部７同士の接合は、陽極電極部７の外周辺の所定部分に内部の金属を露出する切断面９１を設け、各切断面９１間を溶接することで行う。



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【特許請求の範囲】

【請求項１】　金属平板の表面の所定部分に誘電体酸化皮膜を形成し、該誘電体酸化皮膜表面に導電性機能高分子膜を形成し、該導電性機能高分子膜の表面に導電体層を設けることによって、導電体層を陰極電極部とすると共に、導電性機能高分子膜及び導電体層を設けていない金属平板の部分を陽極電極部としてなる平板型固体コンデンサ素子を複数個具備し、該複数個の平板型固体コンデンサ素子を積み重ねてその陰極電極部同士と陽極電極部同士とをそれぞれ接合してなる積層型固体コンデンサにおいて、

前記陽極電極部を少なくとも２重に折り曲げることで陰極電極部の厚みと略同等の厚みにしたことを特徴とする積層型固体コンデンサ。

【請求項２】　表面に誘電体酸化皮膜と導電性機能高分子膜と導電体層とを積層してなる金属平板の導電性機能高分子膜及び導電体層を形成していない端部に、表面に誘電体酸化皮膜を形成してなる金属板製の陽極用補助端子を接合することによって、導電体層を陰極電極部とすると共に、陽極用補助端子を陽極電極部としてなる平板型固体コンデンサ素子を複数個具備し、

各平板型固体コンデンサ素子の陽極電極部となる陽極用補助端子を少なくとも２重に折り曲げることで陰極電極部の厚みと略同等の厚みとし、

且つ前記複数個の平板型固体コンデンサ素子を積み重ねてその陰極電極部同士と陽極電極部同士とをそれぞれ接合してなることを特徴とする積層型固体コンデンサ。

【請求項３】　前記陽極電極部の外周辺の所定部分に内部の金属を露出する切断面を設け、陽極電極部同士の接合は該切断面間の溶接によって形成されていることを特徴とする請求項１又は２記載の積層型固体コンデンサ。

【請求項４】　前記陽極用補助端子上の誘電体酸化皮膜の厚みを、前記金属平板上の誘電体酸化皮膜の表面に電解酸化重合によって導電性機能高分子膜を形成する際に前記陽極用補助端子上の誘電体酸化皮膜表面に該導電性機能高分子膜が形成されない程度まで厚く形成したことを特徴とする請求項２記載の積層型固体コンデンサ。

【請求項５】　前記陽極用補助端子と金属平板との接合は、超音波溶接接合、又は電気的スポット溶接接合、又は機械的圧着接合であることを特徴とする請求項２記載の積層型固体コンデンサ。

【請求項６】　前記陽極用補助端子と金属平板とを接合した部分に、絶縁性樹脂からなる絶縁帯を設けたことを特徴とする請求項２記載の積層型固体コンデンサ。

【請求項７】　前記陰極電極部をリードフレームのリード端子に銀ペーストで接合すると共に、前記陽極電極部をリードフレームの別のリード端子にレーザ溶接で接合し、且つその周囲を絶縁性樹脂でモールド成形したことを特徴とする請求項２記載の積層型固体コンデンサ。

【発明の詳細な説明】

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【０００１】

【発明の属する技術分野】本発明は、誘電体酸化皮膜上に形成した導電性機能高分子膜を固体電解質とする複数個の平板型固体コンデンサ素子を積層してなる積層型固体コンデンサに関するものである。

【０００２】

【従来の技術】電子機器の小型化・携帯化に伴い、高周波領域で動作する特性の良いコンデンサが必要であったが、従来のアルミニウム電解コンデンサや固体タンタル電解コンデンサは、高周波領域において電解質の特性が悪いため、その要求に十分応えることができなかった。

【０００３】一方、導電性機能高分子膜を固体電解質とする固体コンデンサは、導電性機能高分子膜の比抵抗値が従来の液体電解質や二酸化マンガンに比較して非常に小さく（百分の一以下）、このためコンデンサの等価直列抵抗（ＥＳＲ）値やインピターンス値が高周波領域において小さく、前記要求に応えることができるようになってきた。

【０００４】この種の固体コンデンサ素子８０は、図７に示すように、表面を粗面化したアルミ箔（又はアルミ板）からなる金属平板１０１の表面にアルミニウム陽極酸化皮膜（誘電体酸化皮膜）１０３を形成し、アルミニウム陽極酸化皮膜１０３の所定位置の周囲に絶縁帯１０２を印刷して陽極電極部８１と陰極電極部８３に区分し、陰極電極部８３のアルミニウム陽極酸化皮膜１０３の表面に導電性機能高分子膜１０４を形成し、更にその上にグラファイト層１５１と銀ペースト層１５３からなる導電体層１０５を設けて構成されている。

【０００５】

【発明が解決しようとする課題】しかしながら上記従来の導電性機能高分子膜を固体電解質とする固体コンデンサ素子８０を複数個積層した場合には、以下のような問題点があった。

【０００６】即ちこの固体コンデンサ素子８０を積層化するには図８に示すように、複数個の平板型の固体コンデンサ素子８０を積み重ねて、その陰極電極部８３同士と陽極電極部８１同士とをそれぞれ接合することによって行うが、この固体コンデンサ素子８０の陽極電極部８１と陰極電極部８３には厚みの差があり、従ってこれらを複数枚接合した場合、図８に示すように薄い陽極電極部８１を湾曲しなければならず歪が生じてしまう。

【０００７】そしてその歪が陰極電極部８３内に加わると、ショートなどを発生する恐れがあるため、その歪を緩和する必要がある。そこで陽極電極部８１の長さを長く取り、陽極電極部８１同士の接合部と陰極電極部８３同士の接合部との離間距離を長くし、その部分で歪を吸収させていた。しかしながら陽極電極部８１の長さを長く取るとコンデンサの小型化が図れないという問題が生じてしまう。

【０００８】一方陽極電極部８１となるアルミ箔上に絶

縁物質からなるアルミニウム陽極酸化皮膜１０３（図７参照）が被覆されていると、陽極電極部８１同士の接合が困難になってしまうという問題もあった。

【０００９】本発明は上述の点に鑑みてなされたものでありその目的は、陽極電極部と陰極電極部の厚みの差から発生する歪を除去し、また誘電体酸化皮膜が形成された陽極電極部同士の接合を容易にし、これらのことからその積層化が容易に行える積層型固体コンデンサを提供することにある。

【００１０】

【課題を解決するための手段】上記問題点を解決するため本願請求項１に記載の発明は、金属平板の表面の所定部分に誘電体酸化皮膜を形成し、該誘電体酸化皮膜表面に導電性機能高分子膜を形成し、該導電性機能高分子膜の表面に導電体層を設けることによって、導電体層を陰極電極部とすると共に、導電性機能高分子膜及び導電体層を設けていない金属平板の部分を陽極電極部としてなる平板型固体コンデンサ素子を複数個具備し、該複数個の平板型固体コンデンサ素子を積み重ねてその陰極電極部同士と陽極電極部同士とをそれぞれ接合してなる積層型固体コンデンサにおいて、前記陽極電極部を少なくとも２重に折り曲げることで陰極電極部の厚みと略同等の厚みにして構成した。また、請求項２に記載の発明は、表面に誘電体酸化皮膜と導電性機能高分子膜と導電体層とを積層してなる金属平板の導電性機能高分子膜及び導電体層を形成していない端部に、表面に誘電体酸化皮膜を形成してなる金属板製の陽極用補助端子を接合することによって、導電体層を陰極電極部とすると共に、陽極用補助端子を陽極電極部としてなる平板型固体コンデンサ素子を複数個具備し、各平板型固体コンデンサ素子の陽極電極部となる陽極用補助端子を少なくとも２重に折り曲げることで陰極電極部の厚みと略同等の厚みとし、且つ前記複数個の平板型固体コンデンサ素子を積み重ねてその陰極電極部同士と陽極電極部同士とをそれぞれ接合して構成した。

【００１１】

【発明の実施の形態】以下、本発明の実施形態を図面に基づいて詳細に説明する。

〔第一実施形態〕図１は第一実施形態にかかる積層型固体コンデンサの製造方法を示す図である。この積層型固体コンデンサを製造するには同図（ａ）に示すように、まずアルミニウム箔製の金属平板１に所定形状の２つの孔１１，１１を切断などにより形成する。

【００１２】次に同図（ｂ）に示すように、２つの孔１１，１１の間の上部の部分の表裏面にフォトレジスト膜５を印刷形成した後に、同図（ｃ）に示すように金属平板１全体を厚膜化成処理によってフォトレジスト膜５以外の部分にアルミニウム陽極酸化皮膜（誘電体酸化皮膜）８を生成する。

【００１３】次にフォトレジスト膜５を剥離後、同図

（ｄ）に示すようにフォトレジスト膜５を設けた部分の周囲を切断してエッチング処理を行って、フォトレジスト膜５を剥離した部分及び周囲の切断側面を粗面化し、続いて該粗面化された面上にアルミニウム陽極酸化皮膜（誘電体酸化皮膜）を化成化処理によって形成し、その上面に固体電解質となる導電性機能高分子膜を電解酸化重合によって形成し、更にその上面に導電体層（グラファイト層と銀ペースト層からなる）を形成し、これによって平板型固体コンデンサ素子１０を構成する。

【００１４】なお前記導電性機能高分子膜の具体的形成方法としては、特公平１－５８８５６号に記載されている方法と同様に、０．５ｗｔ％ピロール，０．５ｗｔ％ボロジサリチル酸アンモニウム，０．５ｗｔ％純水を含むアセトニトリル溶液中に、前記アルミニウム陽極酸化皮膜を形成した粗面化した金属平板１の部分を浸漬し、金属平板１を陽極にし、対向電極を陰極にして、電解酸化重合を行う方法を用いる。

【００１５】次に同図（ｄ）に示す切断線ｋ－ｋで切断することで、同図（ｅ）に示す平板型固体コンデンサ素子１０を金属平板１から切り出す。この平板型固体コンデンサ素子１０の前記導電体層等を形成した部分が陰極電極部６、導電体層等を形成していない部分が陽極電極部７になる。陽極電極部７はＬ字状に折れ曲がるような形状となる。

【００１６】そして陽極電極部７を同図（ｅ）の折曲線ｅの部分で２重に折り畳んで同図（ｆ）に示す状態とする。

【００１７】そして同図（ｇ）に示すように複数個の平板型固体コンデンサ素子１０を積み重ねてその陰極電極部６同士と陽極電極部７同士とをそれぞれ接合して積層型固体コンデンサを構成する。

【００１８】陰極電極部６同士の接合は導電性接着剤（銀ペースト）によって行い、陽極電極部７同士の接合はその外周辺に設けた切断面９１間をレーザ溶接９することによって行う。陽極電極部７の面はアルミニウム陽極酸化皮膜８で覆われているので、前記図１（ｄ）の切断線ｋ－ｋで金属平板１を切断することで内部のアルミ箔が露出している切断面９１間を溶接するのである。

【００１９】以上のように陽極電極部７を２重に折り曲げたので、陽極電極部７の厚みを陰極電極部６の厚みと略同等にでき、これによって平板型固体コンデンサ素子１０を積層した際に陽極電極部７への歪が減少し又はなくなり、従来に比べて陽極電極部７の長さを短くでき小型化が図れる。

【００２０】〔第二実施形態〕図２，図３は第二実施形態にかかる積層型固体コンデンサの製造方法を示す図である。

【００２１】まず図２（ａ）に示すように、アルミニウム箔製の陽極用補助端子板２１とアルミニウム箔製の金属平板３１とを用意する。

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【００２２】ここで陽極用補助端子板２１は略長方形状であってその一端を幅方向に広げると共に該一端辺中央に凹部２３を設け、該凹部２３の両側に長円形状の貫通孔２５，２５を設けている。そしてこの陽極用補助端子板２１の面全体には化成処理によってアルミニウム陽極酸化皮膜（誘電体酸化皮膜）２７を形成しておく。

【００２３】ここでアルミニウム陽極酸化皮膜２７を形成する方法としては以下のようなものがある。

①ホウ酸，アジピン酸，クエン酸，リン酸又は、その塩等の水溶性電解液を用いて、該水溶性電解液中で、陽極用補助端子板２１を陽極、対向電極を陰極として、該陽極用補助端子板２１上にアルミニウム陽極酸化皮膜２７を形成する方法。

【００２４】②シュウ酸，硫酸又は、その塩等の水溶性電解液を用いて、該水溶性電解液中で、陽極用補助端子板２１を陽極、対向電極を陰極として、該陽極用補助端子板２１上にアルミニウム陽極酸化皮膜２７を形成する方法。

【００２５】なおこのアルミニウム陽極酸化皮膜２７は、下記するアルミニウム陽極酸化皮膜３５と同質のものでも良い。

【００２６】一方金属平板３１は略正方形状であってその一端辺の両側には突出片３３，３３が設けられている。そしてこの金属平板３１の表面全体はエッチングによって粗面化しておく。

【００２７】次に図２（ｂ）に示すように前記金属平板３１の突出片３３，３３を陽極用補助端子板２１の一端辺にその凹部２３をまたぐようにして接触し、電気的スポット溶接によって接合する。

【００２８】なお両者の接合には、電気的スポット溶接の他に、超音波溶接接合や機械的圧着接合を用いても良い。

【００２９】次に前記金属平板３１の表面全体に化成処理によってアルミニウム陽極酸化皮膜（誘電体酸化皮膜）３５を形成する。

【００３０】次に図２（ｃ）に示すように陽極用補助端子板２１と金属平板３１とを接合した部分の金属平板３１側の所定部分の周囲に絶縁性樹脂を塗布して絶縁帯３７を形成する。

【００３１】次に絶縁帯３７によって仕切られた金属平板３１側の面全体に、電解酸化重合によって導電性機能高分子膜を形成し、更にその表面にグラファイト層と銀ペースト層からなる導電体層４５を形成し、図２（ｄ）に示す状態とする。

【００３２】次に図２（ｄ）に示すＡ－Ａ線で陽極用補助端子板２１を切断すると、図３（ａ）に示すように、金属平板３１に２つの陽極用補助端子２９，２９が接合された状態となる。

【００３３】そして２つの陽極用補助端子２９，２９の外側の部分を矢印で示すように裏面側に折り返して２重

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に重ね合わせれば、図３（ｂ）に示すような平板型固体コンデンサ素子２０が完成する。ここで導電体層４５が陰極電極部６３、陽極用補助端子２９，２９が陽極電極部６１となる。

【００３４】次にこの平板型固体コンデンサ素子２０を２個用意し、図４に示すようにこれらの導電体層４５表面に銀ペーストを塗布して積層し、銀ペーストを硬化することによって両導電体層４５，４５間を接合する。

【００３５】このとき陽極用補助端子２９は２重に折り曲げられているのでその厚みが導電体層４５等を積層した陰極電極部６３の厚みと略同一となり、従って平板型固体コンデンサ素子２０を積層するだけで両陽極電極部６１，６１は接続する。

【００３６】次に積層化した２個１組の平板型固体コンデンサ素子２０を２組用意し、これらを図５に示すようにリードフレーム５０の上面と下面にそれぞれ積層する。

【００３７】ここでリードフレーム５０は左右４本ずつのリード端子５１を具備し、その内の６本は平板型固体コンデンサ素子２０の導電体層４５に接合させ、２本は陽極用補助端子２９に接合させている。

【００３８】ここで導電体層４５のリード端子５１への接合は銀ペーストによって行われている。また陽極用補助端子２９とリード端子５１間の接合、及び陽極用補助端子２９同士の接合は、各陽極用補助端子２９の外周辺に形成された切断面２９１とリード端子５１とをレーザ溶接２９３することによって行う。陽極用補助端子２９の面はアルミニウム陽極酸化皮膜２７（図２（ａ）参照）で覆われているので、図２（ｄ）に示す切断線Ａ－Ａで陽極用補助端子板２１を切断することで内部のアルミ箔が露出している切断面２９１間を溶接するのである。

【００３９】これによってアルミニウム陽極酸化皮膜２７で覆われている陽極用補助端子２９であっても、これを積層後に溶接することが可能になり、これによって平板型固体コンデンサ素子２０の積層化が容易に行えるようになった。

【００４０】次にこの積層化した平板型固体コンデンサ素子２０の周囲を図６に示すように、熱硬化性又は熱可塑性樹脂からなる絶縁性樹脂５５でモールド成形した後に、各リード端子５１をリードフレーム５０から切断して、絶縁性樹脂５５から突出するリード端子５１を絶縁性樹脂５５の裏面側に折り曲げれば、チップ型の積層型固体コンデンサが完成する。

【００４１】ところでこの実施形態においては、陽極電極部６１と陰極電極部６３を区分して陽極電極部６１側に導電性機能高分子膜等が積層されないようにするため絶縁帯３７（図２（ｃ）参照）を形成したが、前記陽極用補助端子板２１にアルミニウム陽極酸化皮膜２７を形成する際の化成電圧Ｖ１を、金属平板３１にアルミニウ

ム陽極酸化皮膜３５を形成する際の化成電圧Ｖ２よりも、１０Ｖ以上高い化成電圧とすれば、即ちアルミニウム陽極酸化皮膜３５の厚みよりもアルミニウム陽極酸化皮膜２７の厚みを所定の厚みだけ厚くすれば、導電性機能高分子膜の形成時に前記アルミニウム陽極酸化皮膜２７を形成した部分には該導電性機能高分子膜は形成されなくなり、この実施形態で使用した絶縁帯３７を使用しなくても良くなる。この点は第一実施形態においても同様である。

【００４２】なお誘電体酸化皮膜を形成する金属としては、アルミニウム以外でも、チタン、タンタルやその焼結体など、表面に誘電体酸化皮膜が形成できる金属であれば良い。

【００４３】

【発明の効果】以上詳細に説明したように本発明によれば以下のような優れた効果を有する。

①陽極電極部を少なくとも２重に折り畳んだ状態で積層化したので、陽極電極部と陰極電極部の厚みが略同一となり、平板型固体コンデンサ素子の積層化が容易となり、また陽極電極部に歪が生じなくなってその小型化も図れる。

【００４４】②誘電体酸化皮膜で覆われている陽極電極部を積層化した後にその切断面を溶接するように構成したので、平板型固体コンデンサ素子の積層化が容易になる。

【図面の簡単な説明】

【図１】第一実施形態にかかる積層型固体コンデンサの製造方法を示す図である。

【図２】第二実施形態にかかる積層型固体コンデンサの製造方法を示す図である。

【図３】第二実施形態にかかる積層型固体コンデンサの製造方法を示す図である。

【図４】平板型固体コンデンサ素子２０の積層方法を示す斜視図である。

【図５】積層化した平板型固体コンデンサ素子２０のリードフレーム５０への取り付け方法を示す斜視図である。

【図６】積層化した平板型固体コンデンサ素子２０を用いて形成したチップ型の積層型固体コンデンサを示す斜視図である。

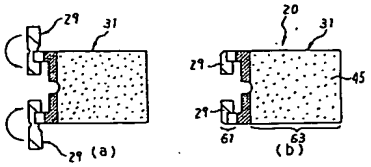
【図７】従来の平板型固体コンデンサ素子８０を示す概略断面図である。

【図８】従来の平板型固体コンデンサ素子８０を積層する方法を示す概略図である。

【符号の説明】

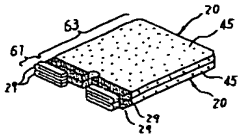
１　金属平板
６　陰極電極部
７　陽極電極部
８　切断面
９　レーザ溶接
１０　平板型固体コンデンサ素子
２０　平板型固体コンデンサ素子
２７　アルミニウム陽極酸化皮膜
２９　陽極用補助端子
２９１　切断面
２９３　レーザ溶接
３１　金属平板
３５　アルミニウム陽極酸化皮膜
３７　絶縁帯
４５　導電体層
５０　リードフレーム
５１　リード端子
５５　絶縁性樹脂

【図３】



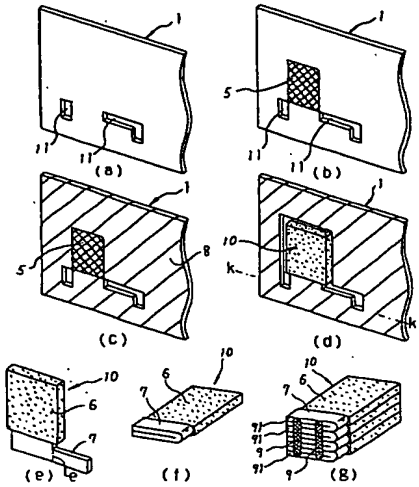
第二実施形態の製造方法を示す図

【図４】



平板型固体コンデンサ素子２０の積層方法を示す図

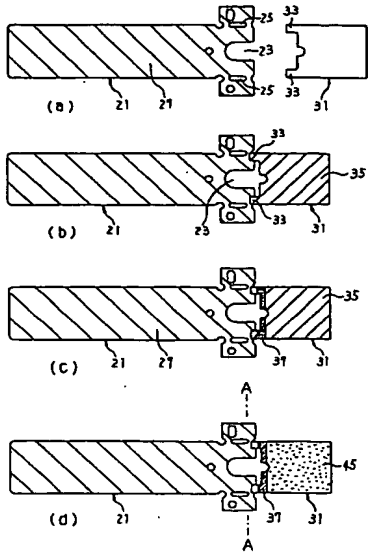
【図１】



１ 金属平板　６ 陰極電極部　７ 陽極電極部　８ 切断面
９ レーザ溶接　１０ 平板型固体コンデンサ素子

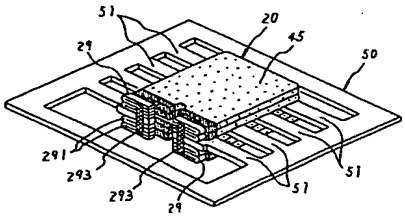
第一実施形態の製造方法を示す図

【図２】



第二実施形態の製造方法を示す図

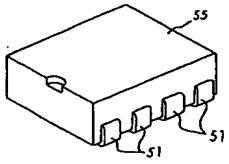
【図５】



２０ 平板型固体コンデンサ素子　２９ 陽極用補助端子　２９１ 切断面
２９３ レーザ溶接　４５ 導電体層　５０ リードフレーム　５１ リード端子

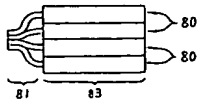
リードフレーム５０への取付方法を示す図

【図６】



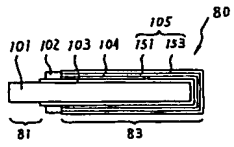
チップ型の実施形態の固体コンデンサを示す図

【図８】



平板型固体コンデンサ素子８０の実施方法を示す図

【図７】



従来の平板型固体コンデンサ素子８０を示す図

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